

## Numbers of wintering waterbirds and their changes over the past 20 years at Caohai, Guizhou Province

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**Abstract:** Caohai, lying on the eastern Yunnan and Guizhou Plateau, is the most important wintering and stopover area for waterbirds in the southwestern China. To document species, their populations, and changes of waterbirds wintering at Caohai, a survey was conducted on 11–12 January 2012. Twenty-six species of waterbirds, with a total of 76,872 individuals were recorded. Of the 26 species of waterbirds, 8 species had a population of more than 1,000, including Common Teal (*Anas crecca*), Black-necked Crane (*Grus nigricollis*), Spot-billed Duck (*Anas poecilorhyncha*), Bar-headed Goose (*Anser indicus*), Tufted Duck (*Aythya fuligula*), Ruddy Shelduck (*Tadorna ferruginea*), Eurasian Wigeon (*Anas penelope*), and Coot (*Fulica atra*). Coot, Eurasian Wigeon, and Ruddy Shelducks each had population of near 10,000 or more. Over the past 20 years, the total counts of waterbirds have been between 50,000–80,000. Numbers of Black-necked Cranes have been increasing steadily, while Eurasian Cranes (*Grus grus*) have been declining. The number of diving ducks is far less than the number of 10,000 diving ducks in 1996, likely due to the decline in water quality at Caohai over the past decades. We recommended the following measures be taken into account in waterbird monitoring and protection: more systematic waterbird count; special attention paid to species or groups with dramatic increase or decrease; land use and change to be monitored; and urgent measures to be taken on pollution, invasive species, urban expansion, and tourists.

**Keywords:** Waterbirds; Black-necked Crane; Population change; Caohai

## 贵州草海越冬水鸟数量及其近 20 年来的变化

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**摘要:** 草海位于云贵高原东缘的贵州省西北部, 是中国西南部最为重要的水鸟越冬地和停歇地。为了确定草海越冬的水鸟种类、数量和草海的分布, 分析近 20 年以来的草海水鸟的数量变化以及变化原因, 于 2012 年 1 月 11–12 日对草海国家级自然保护区越冬水鸟进行了调查。该次调查共计数到水鸟 26 种, 76 872 只。这 26 种水鸟中, 超过 1 000 只个体的有 8 种, 分别为绿翅鸭 (*Anas crecca*)、黑颈鹤 (*Grus nigricollis*)、斑嘴鸭 (*Anas poecilorhyncha*)、斑头雁 (*Anser indicus*)、凤头潜鸭 (*Aythya fuligula*)、赤麻鸭 (*Tadorna ferruginea*)、赤颈鸭 (*Anas penelope*) 和骨顶鸡 (*Fulica atra*)。数量接近或超过 10 000 只的有 3 种, 依次是骨顶鸡、赤颈鸭和赤麻鸭。在过去 20 年, 草海冬季水鸟的总数量为 50 000~80 000 只。黑颈鹤数量呈稳定上升趋势, 而灰鹤数量呈下降趋势。潜鸭类水鸟数量总数不到 2 600 只, 与 1996 年调查的 10 000 多只相差

很大。这可能与草海近 10 年来水质恶化, 导致潜鸭类水鸟植物性食物减少有关。建议把草海水鸟调查工作纳入到保护区的监测保护工作日程中, 每年冬季开展至少一次调查; 使用统一和系统的水鸟监测方法, 使得不同年份的监测结果具有可比性; 密切关注那些种群急剧上升(如黑水鸡)和下降的物种(如潜鸭类); 开展草海土地利用变化的监测工作, 以便探讨土地利用与鸟类之间的相互关系; 在过去 20 年中, 黑颈鹤种群上升, 而灰鹤种群下降, 因此两者之间的相互关系应该加以研究; 草海正在面临很多的诸如污染、外来物种入侵、旅游业等十分迫切的环境问题, 这些环境因子对水鸟种群的影响也亟需加以研究和解决。

**关键词:** 水鸟; 黑颈鹤; 数量变化; 草海

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Caohai is a karst freshwater lake, located in the northwestern Guizhou on the eastern Yunnan and Guizhou Plateau. Caohai ( $N26^{\circ}51'$ ,  $E104^{\circ}14'$ ), with an elevation of 2,170 m at the bottom of the lake and an area of 30  $km^2$  of open water and its surrounding marshes, is the most important wintering and stopover area for waterbirds in the southwestern China. It has 203 bird species, and 70 species of them are waterbirds, with a total of 50,000–70,000 individuals of waterbirds (Li, 1986; Li et al, 2007; Yu et al, 2007; Li, 1997). Each winter, about 1,000 endangered Black-necked Cranes (*Grus nigricollis*) spend winter at Caohai (Li, 2009). Because of its significance in global biodiversity conservation and wetland protection, Caohai was established as a nature reserve in 1985 and upgraded as a national level reserve in 1992. The reserve covers a total area of 120  $km^2$ , including the whole watershed.

Caohai is facing many environmental problems. Caohai is located in one of the poorest regions economically, and several thousand farmer households live within the experimental zones of the reserve, which have heavily relied on natural resources of Caohai. In addition, Caohai is adjacent to county town with 200,000 residents, which has brought a lot of pressure to Caohai, such as urban expansion, sewage and tourists. Due to the above pressure and threats, the Caohai reserve has been dealing a great challenge in resource protection and management.

Resource monitoring is one of the main missions and tasks for nature reserves. Many research and monitoring activities, such as surveys, species ecological studies (Wu et al, 1986; Li, 1999; Li & Ma 1992, 2000; Li & Song, 2005), and inventories (Li, 1986; Yang et al, 1992; Li et al, 2007; Yu et al, 2007; Li, 1999) have been undertaken at Caohai Nature Reserve (CNR) since the reserve was established. There were only two waterbird surveys, however, for the whole lake in the past, one in

1996 (Li, 1997) and the other in 2005 (Yu et al, 2007), which cannot meet the need by the reserve for effective management. The International Crane Foundation and the CNR jointly conducted a waterbird survey on 11–12 January 2012 at Caohai, aiming to (1) determine the species and number of the Caohai wintering at Caohai; (2) the distribution of the waterbirds; (3) determine changes in the waterbird population over the past two decades by comparing this survey to the previous two surveys; and (4) develop recommendations on waterbird monitoring and protection at Caohai.

## MATERIALS AND METHODS

The survey covered the whole lake basin, including the open water, lake shore marshes, and surrounding lowland farmlands, with a total area of 50  $km^2$ . We divided the lake basin into four areas: (1) northern part; (2) western, and southwestern part; (3) southern and eastern parts; and (4) other parts of the basin relatively far away from the lake shore, such as Xuejiahaizi and Suohuangcang. Each area had a survey team to cover. Each team, consisting of 4–7 members, covered 3–5 sites. In each team, there were 1–2 people with good experiences in bird identification and counting.

The survey was taken place in the middle of January of 2012 at Caohai, when the waterbird population was stable. We had a training session on bird classification, identification, and counting technique for all participants on 11 January 2012. At the training session, we also discussed and improved the survey plan. The survey was done on the 12th of January, from 08:30–17:30. The survey day was clear and visibility was very good.

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Numbers of cranes and Common Moorhens were from other survey results. Cranes normally leave their roost sites around 07:30 and many of them go to the upland farmland areas for foraging. We therefore used a roost count from 12 January 2012 for our results. Common Moorhens (*Gallinula chloropus*) move in areas with very dense vegetation cover, it is very hard to get a good count of these birds given the nature of our whole basin waterbird survey. We estimated the number of Common Moorhen based a transect density done by Yu et al (2007) in 2005 at Caohai.

## RESULTS

The survey recorded 26 species of waterbirds, with a total of 76,872 individuals, including 507 Crested Grebes, 65 Greater Cormorants, 218 heron/egrets, 40,145 geese and ducks, 35,472 cranes/coots/rails, 1 shorebird, and 464 gulls (Table 1). Birds from families Anseriformes and Gruiformes were most, accounting for 52% and 46% of the total waterbirds respectively.

Of the 26 species of waterbirds, 8 species had a population of more than 1,000, including Common Teal (1,400), Black-necked Crane (1,400), Spot-billed Duck (*Anas poecilorhyncha*; 2,054), Bar-headed Goose (*Anser indicus*; 2,268), Tufted Duck (*Aythya fuligula*; 2,500), Ruddy Shelduck (*Tadorna ferruginea*; 9,593), Eurasian Wigeon (*Anas penelope*; 18,123), and Coot (*Fulica atra*; 32,382), among which Coot, Eurasian Wigeon, and Ruddy Shelducks each had population of near 10,000 or more.

We actually see only 2 Common Moorhens during this survey on the 12th of January. In fact, Common Moorhen is a resident bird species commonly seen at Caohai. The Common Moorhens forage in areas with dense emergent vegetation cover. Yu et al (2007) calculated a density of 180 birds/km<sup>2</sup> for the Common Moorhen in a 2005 survey. According to the reserve, there were about 5 km<sup>2</sup> in the northern part of Caohai lake where the Common Moorhens were commonly seen, we therefore estimated a total population of 900 for the Common Moorhens.

In our survey, there were three species with less than 3 individuals, and they were 1 Spotted Redshank, 4 Greater Egrets, and 1 Intermediate Egret.

Cranes were the major targeting species for this survey. In recent years, Black-necked Cranes have been around 1,000 and Eurasian Cranes have been 700. Many

cranes went up upland areas for foraging during day time, uplands where our teams could not cover. Therefore during the day time survey, our teams recorded 505 Black-necked and 708 Eurasian Cranes. Instead, we used a roost count for these two species before they went out the lake basin, and recorded 1 400 Black-necked and 790 Eurasian Cranes at their roosting sites (Figure 1).

**Table 1** Waterbirds and their number recorded in January 2012 at Caohai National Nature Reserve, China

	Species	Number (n)
A. Grebes		507
1. Great crested Grebe <i>Podiceps cristatus</i>		507
B. Cormorants		65
2. Great Cormorant <i>Phalacrocorax carbo</i>		65
C. Herons/Egrets		218
3. Grey Heron <i>Ardea cinerea</i>		97
4. Great Egret <i>Ardea alba</i>		4
5. Intermediate Egret <i>Mesophoyx intermedia</i>		1
6. Little Egret <i>Egretta garzetta</i>		116
D. Geese		2,268
7. Bar-headed Goose <i>Anser indicus</i>		2,268
E. Shelducks		9,593
8. Ruddy Shelduck <i>Tadorna ferruginea</i>		9,593
F. Puddle Ducks		22,587
9. Pintail <i>Anas acuta</i>		202
10. Northern Shoveler <i>Anas clypeata</i>		26
11. Eurasian Wigeon <i>Anas penelope</i>		18,123
12. Spot-billed Duck <i>Anas poecilorhyncha</i>		2,054
13. Falcated Duck <i>Anas falcata</i>		110
14. Mallard <i>Anas platyrhynchos</i>		619
15. Common Teal <i>Anas crecca</i>		1 400
16. Gadwall <i>Anas strepera</i>		53
G. Diving Ducks		2,597
17. Tufted Duck <i>Aythya fuligula</i>		2,500
18. Ferruginous Duck <i>Aythya nyroca</i>		12
19. Goosander <i>Mergus merganser</i>		85
Unknown ducks		3,100
H. Cranes		2,190
20. Black-necked Crane <i>Grus nigricollis</i>		1,400 <sup>a</sup>
21. Eurasian Crane <i>Grus grus</i>		790 <sup>a</sup>
I. Coots		33,282
22. Eurasian Coot <i>Fulica atra</i>		32,382
23. Common Moorhen <i>Gallinula chloropus</i>		900 <sup>b</sup>
J. Others		465
24. Spotted Redshank <i>Tringa erythropus</i>		1
25. Brown-headed Gull <i>Larus brunnicephalus</i>		27
26. Black-headed Gull <i>Larus ridibundus</i>		437
Total		76,872

<sup>a</sup> Roost counts on January 12, 2012 were used for Black-necked and Eurasian Cranes

<sup>b</sup> Number for Common Moorhen was estimated based on density by Yu et al (2005)

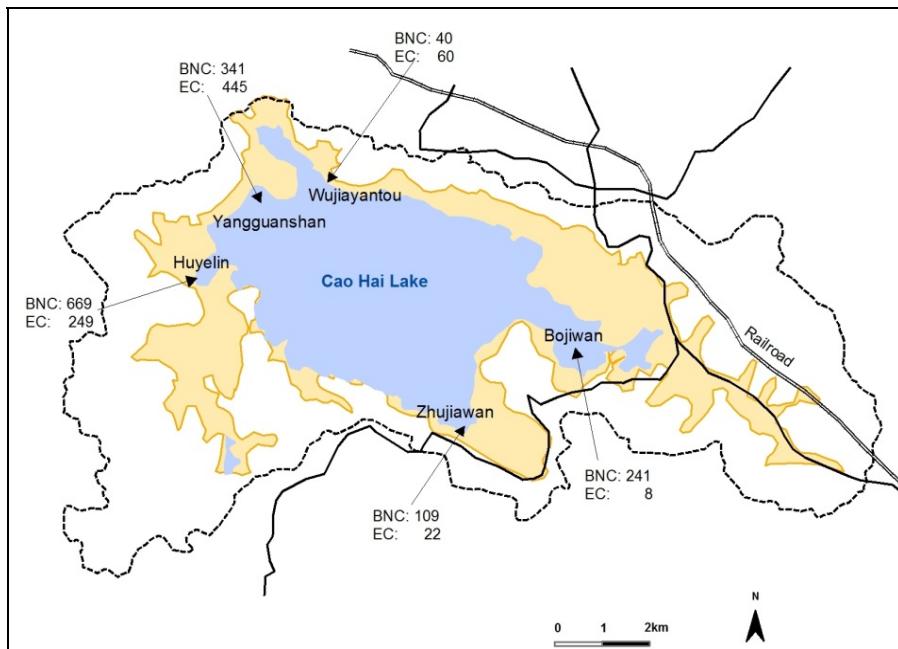


Figure 1 Numbers and location of Black-necked (BNC) and Eurasian Cranes (EC) at Caohai on the 12 January 2012. These numbers are roost count.

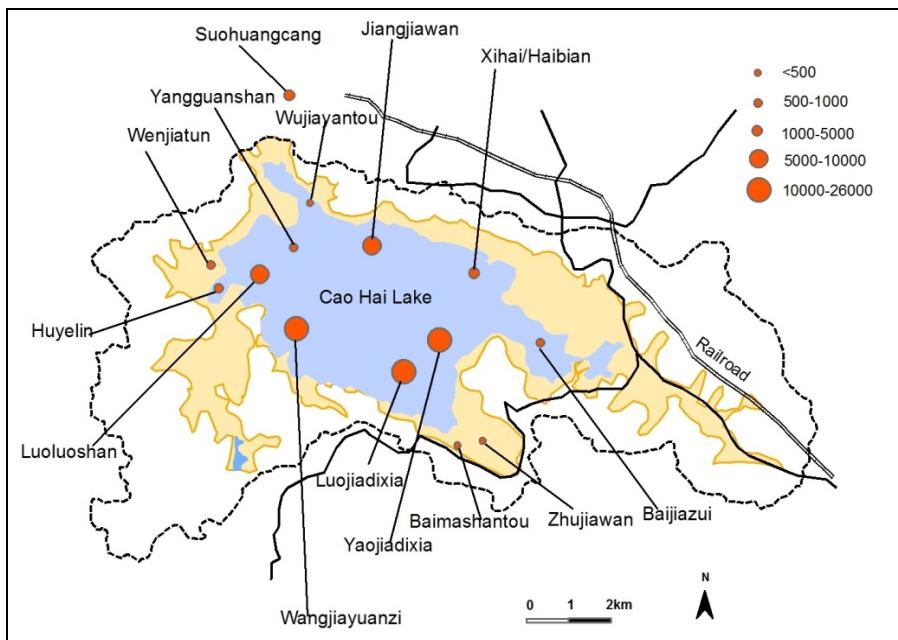


Figure 2 Numbers and location of waterbirds recorded in January 2012 at Caohai. The circles indicate sizes of waterbird populations and location of the circle is the center of an area covered by survey team.

Waterbirds mostly concentrated in the middle and southern parts of the lake (Figure 2). Among the 13 sites surveyed, five sites including Yaojiadixia, Luojiadixia, Wangjiayuanzi, Luoluoshan and Jiangjiawan, each had a count of over 1,000 waterbird individuals. Yaojiadixia and Luojiadixia had the most waterbirds, with 25,921 and 13,959 respectively, together accounting for 53.2% of the total water bird count at Caohai.

## DICUSSION

The total count of waterbirds from this survey was similar to previous two surveys, all between 50,000–80,000 (Table 2), indicating the total population of waterbirds has not changed too much. Populations of some birds however have changed quite dramatically.

**Table 2** Waterbirds and their number recorded in March 1-4, 1996 and winter of 2005 at Caohai National Nature Reserve, China

Species	March 1-4, 1996 <sup>a</sup>	Winter 2005 <sup>b</sup>
A. Grebes		
1. Little Grebe <i>Tachybaptus ruficollis</i>	117	
B. Cormorants		
2. Great Cormorant <i>Phalacrocorax carbo</i>	13	
C. Herons/Egrets		
3. White Spoonbill <i>Platalea leucorodia</i>	3	
4. Grey Heron <i>Ardea cinerea</i>	30	
5. Little and Great Egrets <i>Egretta garzetta</i> & <i>Ardea albus</i>	25	
D. Geese		
6. Bar-headed Goose <i>Anser indicus</i>	480	
7. Greylag Goose <i>Anser anser</i>	3	
E. Shelducks		
8. Common Shelduck <i>Tadorna tadorna</i>	6	
9. Ruddy Shelduck <i>Tadorna ferruginea</i>	2,583	
F. Puddle Ducks		
10. Pintail <i>Anas acuta</i>	1,413	3,000
11. Northern Shoveler <i>Anas clypeata</i>	384	<450
12. Eurasian Wigeon <i>Anas penelope</i>	12,122	>4,000
13. Spot-billed Duck <i>Anas poecilorhyncha</i>	936	<450
14. Falcated Duck <i>Anas falcata</i>	60	
15. Mallard <i>Anas platyrhynchos</i>	2,154	6,150
16. Common Teal <i>Anas crecca</i>	838	
17. Garganey <i>Anas querquedula</i>	20	
18. Gadwall <i>Anas strepera</i>	2,037	>5,500
Unknown puddle ducks	11,310	
G. Diving Ducks		
19. Tufted Duck <i>Aythya fuligula</i>	831	
20. Common Pochard <i>Aythya ferina</i>	931	>4,500
21. Ferruginous Duck <i>Aythya nyroca</i>	37	
22. Red-crested Pochard <i>Rhodonessa rufina</i>	136	
23. Common Goldeneye <i>Bucephala clangula</i>	0	
24. Baer's Pochard <i>Aythya baeri</i>	16	
25. Goosander <i>Mergus merganser</i>	37	
26. Smew <i>Mergus albellus</i>	3	
Unknown diving ducks	10,407	
H. Cranes/Coots/Lapwings		
27. Black-necked Crane <i>Grus nigricollis</i>	249	
28. Eurasian Crane <i>Grus grus</i>	88	
29. Eurasian Coot <i>Fulica atra</i>	27,865	15,800
30. Northern lapwing <i>Vanellus vanellus</i>	101	
31. Common Moorhen <i>Gallinula chloropus</i>		180 birds/km <sup>2</sup>
Total	75,235	50,000-60,000

<sup>a</sup> Based on a count in 1996 (Li, 1997), in which shorebirds and gulls were not included in the survey.

<sup>b</sup> Based on Yu et al (2007), with correction on estimation on density of moorhens.

### Black-necked and Eurasian Cranes

Over the past decades, numbers of Black-necked Cranes wintering at Caohai have been increasing steadily, mainly due to stricter law enforcement; poaching of Black-necked Cranes totally stopped at Caohai and most other places with this species. This increase is consistent to the population trend of this species on the Yunnan and Guizhou Plateau. In Yunnan, number of Black-necked Cranes increased from 1,663 in 1,994 (Wang, 2005), to 2,493 in 2004 (Yang, 2005). At Caohai, the number of this species increased from less than 400 in early 1990s (Li & Yang, 2005), to about 1,000 in recent years (Li, 2009).

Population situation of Eurasian Cranes at Caohai is different from Black-necked Cranes. In February 1983, Wang (1986) counted 2,178 birds. Yang et al (1992) reported 1,655 in 1985, 1,304 in 1986, 1,024 in 1987, and only 640 in 1989. There were 553, 528 and 514 Eurasian Cranes from 2002-2004 respectively at Caohai (Yang, 2005). In recent years, the population of this species has increased some, with counts of 1,202 in 2006 (Li, 2007), 774 in 2007 (Caohai National Nature Reserve, 2008), and 973 in 2008 (Li, 2009). Our survey recorded 790 birds. In the past 15 years, the counts of this species have rarely been close to 1,000 individuals. The population decline of species may be related to the increase of Black-necked Cranes, as they might have competed foraging habitats and food resources.

### Paddle Ducks

Paddle ducks have a total number of 20,000-30,000, mainly Eurasian Wigeon, Common Teal, Gadwall, and Spot-billed. This survey recorded 18,000 Eurasian Wigeon, more than what was counted in 1997 when recorded 12,100 (Table 2). However, this does not mean Eurasian Wigeon has increased at Caohai, since there were more than 10,000 un-identified paddle ducks recorded in 1996, which might include many Eurasian Wigeon.

### Diving Ducks

This survey recorded less than 2,600 diving ducks, plus 3,100 un-identified ducks that might include some of diving ducks. Still, the number of diving ducks is far less than the number of 10,000 diving ducks in 1996. The diving ducks need relatively high quality water areas to survive. The decline in water quality at Caohai over the past decades is likely one of main reasons for the decrease of diving ducks. Another reason for the few

count of diving ducks might be survey methods used between the two surveys. In 1996, we focused on open water areas by sampling 3 transects on the lake by boats (Li, 1997), and got a better estimate for the birds in the middle of the lake where diving ducks were. Our survey this time mainly by walking along the lake shores, where it was harder to see and count birds in the open water areas on the lake.

### Common Moorhen

Over the past ten years, numbers of Common Moorhen have increased dramatically, most concentrating in northern part of the lake where water is shallow. This area was designed as a waterbird breeding zone in 2002, and was enclosed with cement poles and wires (Li, 2009). In this enclosure, boats and people are not allowed to enter, therefore vegetations are tall and dense, a suitable habitat for the Common Moorhens. A more recent survey done by the CNR estimated a total population of 3,000 for Common Moorhen at Caohai.

In summary, for the future waterbird monitoring and protection on Caohai, we recommend following measures: (1) Waterbird survey should be included in the regular resource monitoring by the reserve, and should be done at least one each winter; (2) When conducting the waterbird survey, methods should be kept consistent, to make more comparable among the counts among

years; (3) Pay more attention to species or groups with dramatic increase such as Common Moorhen, and decrease such as diving ducks. Special studies need to be done to determine causes for these dramatic changes, in order to provide sound recommendations for adaptive conservation and management; (4) In the same time, land use and change should be monitored as well, so determine the impact of land use change to bird resources at Caohai; (5) Cranes are flagship species at Caohai. Over the past 20 years, Black-necked Crane and Eurasian Crane have experienced different population changes. More research is needed to determine ecological relation between these two crane species; and (6) Caohai is facing many serious threats and pressure, including pollution, invasive species, urban expansion, and tourists. It is urgent to study and monitor how these factors impact waterbird populations at Caohai.

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